

## Case Report

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# Surgical management of a traumatic elbow dislocation with disruption of the brachial artery

## Case report

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### Abstract

**Background:** Dislocations of the elbow are the second most common dislocations of humeral joints following the shoulder. Besides numerous possible concomitant injuries of the collateral ligaments or the extensor or flexor apparatus, an accompanying disruption of the brachial artery is a rare occurrence. In the following, such a case is presented and discussed.

**Method:** A 70-year-old woman sustained a closed posterior elbow dislocation with accompanying disruption of the brachial artery due to a fall in a domestic environment. Pulselessness of the radial artery led to a computed tomography angiography being performed, which confirmed the diagnosis. Direct operative vascular reconstruction with a vein insert was carried out. Due to strong swelling of the soft tissue, other examinations of the elbow could not be performed initially. A redislocation a few days later led to an operative stabilization of the elbow joint.

**Results:** The final consultation 4 months postoperatively showed a stable, centered elbow joint and a normal perfusion of the affected arm. The elbow function was good with a range of motion of 0/0/110° of extension/flexion.

**Conclusion:** An elbow dislocation is a complex injury. An accurate clinical examination of possible concomitant injuries is important and should be repeated in the first few days after the occurrence. Vascular reconstruction should be performed immediately. In the case of persistent joint instability, an operative stabilization is indicated and may be supported by a hinged external fixator.

### Keywords

Elbow joint · Vascular reconstruction · Orthopedic surgery · Joint instability · Hinged external fixator



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Dislocations of the elbow are the second most common dislocations of human joints following the shoulder [1–4, 6]. In about 80% of the cases, a posterior dislocation occurs [1–3]. An elbow dislocation represents a complex injury and it is crucial to determine the correct primary treatment in order to achieve good functional results. Frequent concomitant injuries are partial

or complete ruptures of the medial and lateral collateral ligaments and/or of the extensor or flexor apparatus, as well as bony avulsions of the inserting tendons or ligaments at the humeral epicondyles or fractures of the coronoid process [1]. However, an accompanying damage of the brachial artery is rare, with a reported occurrence of 0.47% [4, 5].



**Fig. 1** ▲ Computed tomography angiography showing complete disruption of the brachial artery

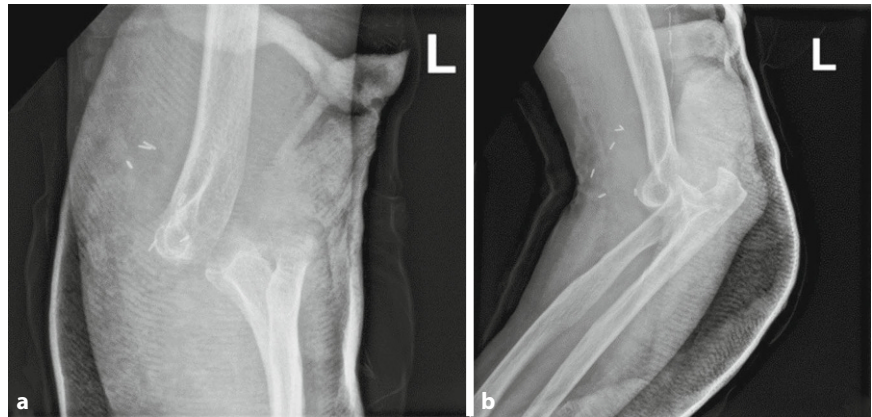
In the following, such a case is presented and discussed.

### Case report

A 70-year-old woman sustained a closed posterior elbow dislocation with accompanying rupture of the brachial artery, caused by a fall in the domestic environment. Primary treatment was carried out in a rural hospital where closed reduction of her elbow was performed. After reduction, persistent pulselessness and paleness of the extremity was observed and the patient was referred to our level-1 trauma center, where computed tomography (CT) angiography was carried out. It showed a disruption of the brachial artery about 5 cm proximal to the elbow joint, in addition, bony avulsions of the radial and ulnar collateral ligaments at the medial and lateral epicondyle were observed (■ Fig. 1). Clinical inspection showed massive swelling of the forearm and neither the ulnar nor the radial pulse could be palpated at the wrist. Sensitivity in all fingers was reduced due to preexisting polyneuropathy; however, no new neurological deficits were reported.

### Surgery

An emergency intervention with vascular reconstruction of the brachial artery with a vein insert harvested from the great saphenous vein was performed through a midline incision of approximately 10 cm. Direct surgical stabilization of the elbow was contraindicated because of the patient's advanced age, the strong swelling



**Fig. 2** ▲ Redislocation in the cast in (a) anteroposterior and (b) lateral view

of the forearm, and the midline incision. As the elbow was stable during intraoperative image intensifier testing, immobilization and retainment instead of application of an external fixator was realized. However, on day 2 after surgery a spontaneous redislocation occurred in the cast (■ Fig. 2) and after closed reduction, surgery was indicated and planned.

The swelling of the elbow had decreased sufficiently 5 days after reconstruction of the brachial artery and a second operation was performed in order to stabilize the elbow.

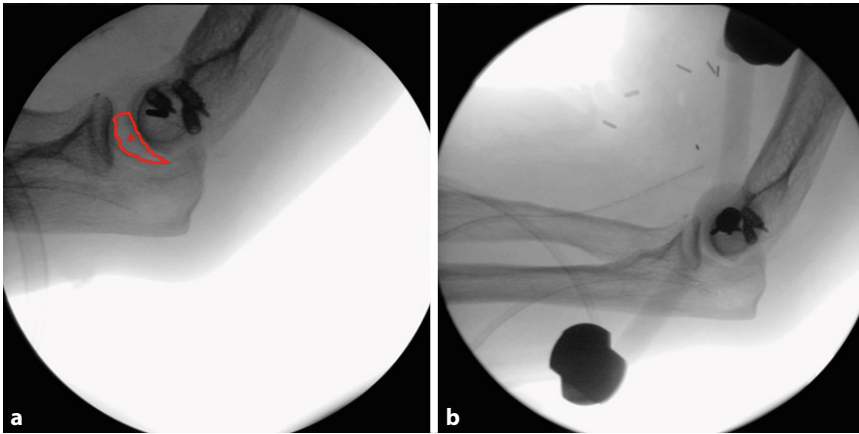
The surgery took place with the patient in supine position without a tourniquet. On the medial side, a semicircular incision was made over the ulnar epicondyle and the ulnar nerve was exposed and neurolyzed. The flexor apparatus was completely ruptured and a bony avulsion of the medial collateral ligament at its humeral insertion was observed. First, an all-suture anchor was applied; however, due to the poor bone quality an anchor cut-out occurred after a slight pull. As an alternative, two 4.5-mm Corkscrew® suture anchors (Arthrex, Naples, CA, USA) were chosen. The first anchor was used to fix the anterior portion of the ulnar collateral ligament (UCL) and the medial part of the joint capsule in a modified Mason–Allen suture technique. A second anchor was used to attach the flexor apparatus and the posterior portion of the UCL, which was only partially torn. In the next step, on the radial side a Kocher approach was carried out with the arm in maximal pronation in order to protect the deep radial

nerve. A complete rupture of the extensor apparatus as well as a bony avulsion of the radial ligament complex was observed. Radial stabilization was performed using another 4.5-mm Corkscrew® suture anchor. The ensuing stability tests with the image converter showed a persistent drop sign (■ Fig. 3). Therefore, a hinged external fixator (DePuy/Synthes, West Chester, PA, USA) was mounted to give additional stability. A postoperative X-ray showed a regular joint position and sensorimotor inspection was unremarkable.

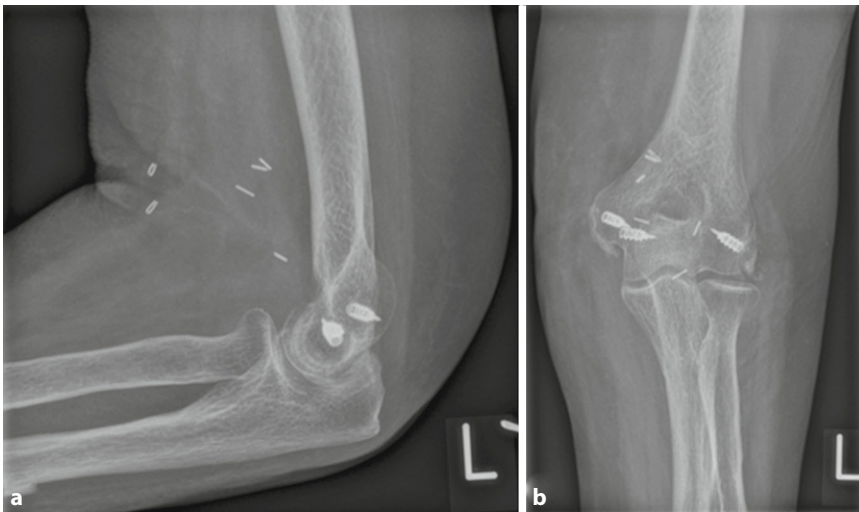
### Follow-up and outcome

The hinged external fixator was retained for 6 weeks, accompanied by constant physiotherapeutic treatments according to an overhead motion protocol with an extension limit of 30°. After 6 weeks, the external fixator was removed and an external elbow brace (EpicorOM, Medi, Bayreuth, Germany) with extension and flexion limitation of 0–0–120° was applied for another 6 weeks in order to further protect the elbow as the patient only ambulates with a walker due to the preexisting neuropathy. The final consultation took place 6 months postoperatively:

Radiography showed a centered elbow joint without any signs of instability (■ Fig. 4). The range of motion of the left elbow was extension/flexion 0/0/110° and pronation/supination 60/0/90° (■ Fig. 5). In comparison, her right elbow allowed 0/0/140° of extension/flexion and 90/0/90° of pronation/supination. Except for the polyneuropathy, the patient had no sen-



**Fig. 3** ▲ Intraoperative lateral X-rays before (a) and after (b) application of the hinged external fixator. a “Drop sign” (red asterisk); b after mounting the external fixator, the ulnohumeral joint is centered



**Fig. 4** ▲ Lateral (a) and anteroposterior (b) radiographs at final follow-up showing a centered elbow joint



**Fig. 5** ▲ Flexion (a) and extension (b) 6 months postoperatively

sorimotor deficits. She only reported slight irritation in the area of the previous external fixator pin sites and negated pain in the elbow as well as in the distal radioulnar joint. The patient was very satisfied with the outcome and rated her elbow with a subjective elbow value (SEV) of 60. According to the Broberg and Morrey Score [12], her elbow achieved 87 of 100 points, representing a good clinical result.

## Discussion

Avulsion injuries of the brachial artery in the course of an elbow dislocation are very rare with an occurrence of less than 1% [4, 5]. However, as this case demonstrates, perfusion of the affected arm always has to be checked before and after reduction. In this case, the reported pulselessness and paleness were obvious clinical features of a damaged blood supply and the CT angiography confirmed the suspicion. Nevertheless, findings are not always that definite [6]. In approximately 40% of the cases, the typical signs of ischemia are missing [5] as the elbow vascularization is often assisted by an extensive collateral circulation that may compensate and mask a vessel occlusion or rupture [1, 4–7].

Residual instability can also go unnoticed at first. It is recommended to test the stability by applying varus and valgus stress and in posterolateral direction in the functional arc, i.e., between 30° of extension and 130° of flexion [1–3, 8, 9]. Some authors recommend examination under analgosedation or anesthesia [2, 9]. If a simple elbow dislocation is stable, conservative treatment is indicated [1, 2, 10]; however, signs of persistent instability such as a redislocation indicate the necessity of a surgical intervention [1–4, 11]. Regular clinical follow-up examinations have to be performed in the first weeks in cases of conservative treatment [1, 9]. In the case of our patient, due to the soft tissue situation after brachial artery reconstruction and the patient’s advanced age, primary conservative treatment of the elbow instability was chosen. Redislocation occurred 2 days later while changing the dressings, and the persistent instability made surgical treatment necessary. After stabilization with suture anchors, an ulnar

drop sign persisted; therefore, a hinged external fixator was mounted additionally to increase primary stability and enable direct active motion exercising. According to general consensus, early postoperative mobilization is important to avoid elbow stiffness [1–4, 11].

Retrospectively, the redislocation—which represents an extremely delicate situation in the case of a recently reconstructed artery—could have been prevented by applying an external fixator in the first operation. Therefore, in cases of doubtful joint stability after vascular reconstruction, the primary application of an external fixator is absolutely recommended in order to protect the vascular implant. In these cases, a redislocation has to be strictly avoided.

Overall, our patient showed a very satisfying outcome 6 months postoperatively. Compared to the other arm, only slight movement restrictions can be observed (range of motion 110° on the left side vs. 140° on the right). In addition, the patient is completely free from pain and no restrictions in daily living are reported. Besides, no surgical complications such as infection, nerve damage, or anchor cut-out have occurred.

### Practical conclusion

- Simple elbow dislocations may be accompanied by serious concomitant lesions such as vascular injuries. Thus, it is crucial to check the wrist pulses before and after reduction.
- In extreme soft tissue swelling, a two-stage surgical approach is an option. If a vascular reconstruction was performed, primary stabilization with an external fixator is very important to prevent redislocation, even in cases of a simple elbow dislocation in elderly patients. Longer casting might lead to occlusion of the reconstructed vessel or a missed forearm compartment syndrome.
- Due to reduced bone quality in some cases, all-suture anchors are insufficient and larger screw anchors should be applied. If a persistent drop sign is observed in the intraoperative lateral X-ray, application of an additional hinged external fixator should be considered to increase primary stability and protect the soft tissue reconstruction.
- In osteoporosis, pin loosening of the external fixator might be an issue; a hinged external fixator should be used to minimize shear forces.

## Chirurgische Versorgung einer traumatisch bedingten Ellenbogenluxation mit Riss der A. brachialis. Fallbericht

**Hintergrund:** Eine Luxation des Ellenbogens stellt die zweithäufigste Luxation des menschlichen Körpers dar. Neben verschiedenen möglichen Begleitverletzungen im Bereich des Kapsel-Band-Apparats und der Sehnenansätze ist eine Abrissverletzung der A. brachialis eine Seltenheit. Im Folgenden wird ein solcher Fall präsentiert und diskutiert.

**Methoden:** Eine 70 Jahre alte Frau stürzte im häuslichen Umfeld und erlitt eine geschlossene Luxation des linken Ellenbogens mit begleitendem Abriss der A. brachialis. Fehlende Pulse der A. radialis führten zur Zuverlegung und zur Anfertigung einer computertomographiegesteuerten Angiographie, welche die Diagnose bestätigte. Die operative Gefäßrekonstruktion mittels Veneninterponat erfolgte sofort. Aufgrund stark geschwollener Weichteilverhältnisse waren weitere Untersuchungen des Ellenbogengelenks zunächst nicht möglich. Ein Reluxationsereignis einige Tage nach dem Unfall veranlasste zu weiterführender Diagnostik und operativer Stabilisierung des Ellenbogens.

**Ergebnisse:** Die Nachuntersuchung 4 Monate postoperativ zeigte ein stabiles, zentriertes Ellenbogengelenk, eine regelrechte Durchblutung des betroffenen Arms sowie eine gute Ellenbogenfunktion mit einem Bewegungsausmaß von 0/0/110° Extension/Flexion.

**Schlussfolgerung:** Eine Luxation des Ellenbogens ist eine komplexe Verletzung. Eine sorgfältige klinische Untersuchung aller möglichen Begleitverletzungen ist wichtig und sollte in den ersten Tagen mehrmals wiederholt werden. Gefäßverletzungen sollten sofort operativ behandelt werden. Bei persistierenden Gelenkinstabilitäten und Reluxationstendenzen ist eine operative Stabilisierung des Gelenks durchzuführen, welche durch die Anlage eines Bewegungsfixateurs unterstützt werden kann.

### Schlüsselwörter

Ellenbogengelenk · Vaskuläre Rekonstruktion · Orthopädische Chirurgie · Gelenkinstabilität · Bewegungsfixateur

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### Declarations

**Conflict of interest.** J. Habarta, M. Jordan, R. Meffert, H. Huflage and J. Schmalzl declare that they have no competing interests.

For this article no studies with human participants or animals were performed by any of the authors. All studies mentioned were in accordance with the ethical standards indicated in each case. Additional written informed consent was obtained from all individual participants or their legal representatives for whom identifying information is included in this article.

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